NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

TECHNICAL NOTE

No. 1507

SYMBOLS FOR COMBUSTION RESEARCH

By NACA Subcommittee on Combustion

Flight Propulsion Research Laboratory
Cleveland, Ohio

Washington
June 1948

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INTRODUCTION

Because the NACA Subcommittee on Combustion recognizes the need for standard combustion symbols to facilitate the exchange of technical information and to provide a basis for comparison of results obtained by various investigators, such a list of symbols has been prepared. An attempt has been made to be consistent with long accepted usage in the fields of thermodynamics and aerodynamics.

These symbols for combustion research were prepared by the Panel consisting of Dr. Ernest F. Fiock, chairman, Dr. Bernard Lewis, Mr. L. Richard Turner, Dr. Stewart Way, and Professor Glenn C. Williams. They were recommended to the Power Plants Committee of the NACA by its Subcommittee on Combustion at a meeting of the subcommittee held September 25, 1946, and were approved by the Committee on Power Plants for Aircraft on May 12, 1947 and by the Executive Committee of the NACA on June 5, 1947. The membership of the NACA Subcommittee on Combustion at the time of the adoption of these symbols was as follows:

Professor Glenn C. Williams, Chairman, Massachusetts Institute of Technology
Mr. G. L. Wander, Air Materiel Command, Wright Field
Lt. Comdr. C. C. Hoffman, U. S. N. Bureau of Aeronautics
Dr. Ernest F. Fiock, National Bureau of Standards
Dr. Bernard Lewis, Bureau of Mines
Dr. W. T. Olson, NACA, Cleveland Laboratory
Mr. A. M. Rothrock, NACA
Dr. W. G. Berl, Johns Hopkins University
Mr. A. J. Nerad, General Electric Company
Professor Robert N. Pease, Princeton University
Dr. William J. Sweeney, Standard Oil Development Company
Dr. Stewart Way, Westinghouse Electric Corporation

SYMBOLS, DIMENSIONS, AND TYPICAL UNITS

Symbol	Concept	Dimensions	Typical units
A	area, cross sectional	L^2	sq ft
C	coefficient	none	none
C_x	concentration; moles of substance "x" per unit volume	m/L^3	lb moles/cu ft
c	velocity of sound $\left(\sqrt{\left(\frac{\delta p}{\delta \rho}\right)}\right)$	L/t	ft/sec
c_p	specific heat at constant pressure	L^2/t^2T	Btu/(lb)(°F)
c_v	specific heat at constant volume	L^2/t^2T	Btu/(lb)(°F)
D	diameter	L	ft
e	specific internal energy	L^2/t^2	Btu/lb
F	thrust; force	mL/t^2	lb
f	fuel-air ratio	none	none
g	standard acceleration of gravity	L/t^2	ft/sec^2
h	specific enthalpy	L^2/t^2	Btu/lb
h_c	specific lower heat of combustion; ideal enthalpy change for isothermal constant-pressure combustion with product water remaining in vapor phase	L^2/t^2	Btu/lb
h_t	total specific enthalpy	L^2/t^2	Btu/lb
h_v	specific enthalpy of vaporization at constant pressure	L^2/t^2	Btu/lb

Symbol	Concept	Dimensions	Typical units
J	mechanical equivalent of heat	none	none
K	constant	none	none
L	length	L	ft
M	Mach number; also molecular weight	none	none
m	mass, total	m	slugs
n	polytropic exponent	none	none
p	absolute static pressure	m/Lt^2	lb/sq ft
p_t	absolute total pressure	m/Lt^2	lb/sq ft
Q	total quantity of heat transferred by conduction, convection, or radiation; also volume rate of flow	mL^2/t^2 L^3/t	Btu cu ft/sec
q	dynamic pressure; one-half momentum flux per unit area	m/Lt^2	lb/sq ft
R	universal gas constant	L^2/t^2T	ft-lb/(°F)(mole)
r	pressure ratio	none	none
S	area, surface	L^2	sq ft
s	specific entropy	L^2/t^2T	Btu/(lb)(°F)
T	absolute static temperature	T	°R
T_t	absolute total temperature	T	°R
t	time	t	sec
V or u	velocity	L/t	ft/sec

Symbol	Concept	Dimensions	Typical units
v	specific volume	L^3/m	cu ft/lb
W	weight flow per unit time	mL/t^3	lb/sec
γ or k	specific-heat ratio (c_p/c_v)	none	none
Δ	finite change or difference	none	none
δ	static pressure divided by NACA standard sea-level pressure	none	none
δ_t	total pressure divided by NACA standard sea-level pressure	none	none
η	efficiency	none	none
θ	static temperature divided by NACA standard sea-level temperature	none	none
θ_t	total temperature divided by NACA standard sea-level temperature	none	none
λ	wave length	L	ft
μ	absolute viscosity	m/Lt	lb sec/sq ft
ν	frequency; also kinematic viscosity (μ/ρ)	L^2/t	sq ft/sec
ρ	specific density	m/L^3	slugs/cu ft
σ	specific density divided by NACA standard sea-level density	none	none
τ	ratio of two static temperatures; also, characteristic time of a thermocouple	none t	none sec
τ_t	ratio of two total temperatures	none	none

SUBSCRIPTS

Numerical subscripts shall be used to indicate positions in an apparatus, process, or cycle. When used to indicate stations in a burner, the numbers assigned to the stations shall increase from inlet to exit.

a	air	f	fuel
ad	adiabatic	h	heat exchanger or intercooler
am	ambient	i	indicated
av	average	is	isentropic
b	burner or burned gas	j	jet or exhaust nozzle
c	compressor	n	nozzle or net
calc	calculated	sl	NACA standard sea level
corr	corrected	std	standard
cr	critical	t	total or turbine
d	diffuser or duct		

Flight Propulsion Research Laboratory,
National Advisory Committee for Aeronautics,
Cleveland, Ohio, March 11, 1948.